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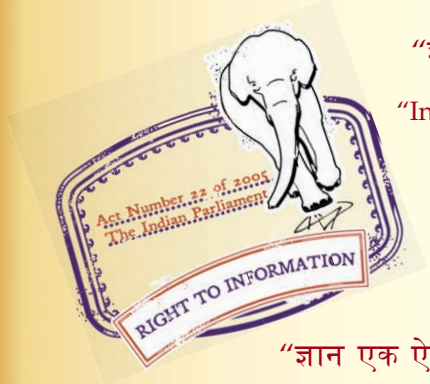

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Indian Standard

METHOD FOR CALIBRATION OF STANDARDIZED BLOCKS TO BE USED FOR VICKERS HARDNESS TESTING MACHINES

PART 1 HV 0·2 TO HV 100

(First Revision)

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Indian Standard

METHOD FOR CALIBRATION OF STANDARDIZED BLOCKS TO BE USED FOR VICKERS HARDNESS TESTING MACHINES

PART 1 HV 0·2 TO HV 100

(First Revision)

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Indian Standard

METHOD FOR CALIBRATION OF STANDARDIZED BLOCKS TO BE USED FOR VICKERS HARDNESS TESTING MACHINES

PART 1 HV 0·2 TO HV 100

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part 1) (First Revision) was adopted by the Indian Standards Institution on 25 October 1986, after the draft finalized by the Methods of Physical Tests Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard was first published in 1967. Subsequently, it was decided by the Sectional Committee to revise this standard in two parts in the light of the work done by ISO/TC 164 Mechanical Testing of Metals at the international level. This part covers method for calibration of standardized blocks to be used for Vickers hardness testing machines for hardness range HV 0·2 to HV 100. Part 2 covers the method for calibration of standardized blocks to be used for Vickers hardness testing machines for hardness range less than HV 0·2.

0.3 In the preparation of this standard, assistance has been derived from ISO 640-1984 Metallic materials—Hardness test-Calibration of standardized blocks to be used for Vickers hardness testing machine, issued by the International Organization for Standardization (ISO).

0.4 In this revision, the main modification made relates to the adoption of SI units.

0.5 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard (Part 1) specifies a method for the calibration of standardized blocks to be used in Vickers hardness testing machines for test forces from 1·961 to 980·7 N (HV 0·2 to HV 100), for the indirect verification of these machines, as specified in IS : 1754 (Part 1)-1986†.

*Rules for rounding off numerical values (*revised*).

†Verification of Vickers hardness testing machines: Part 1 HV 0·2 to HV 100 (*second revision*).

2. MANUFACTURE

2.1 The block shall be specially prepared and the attention of the manufacturer is drawn to the need to use a manufacturing process which will give the necessary homogeneity, stability of structure and uniformity of surface hardness.

2.2 Each metal block to be standardized shall be of a thickness not less than 6 mm.

2.3 The standardized blocks shall be free from magnetism. It is recommended that the manufacturer shall ensure that the blocks, if of steel, have been demagnetized at the end of the manufacturing process.

2.4 The maximum deviation in flatness of the surfaces shall not exceed 0·005 mm.

2.4.1 The maximum error in parallelism shall not exceed 0·010 mm in 50 mm.

2.5 The test surface shall be free from scratches which interfere with the measurement of the indentations. The surface roughness R_a shall not exceed 0·05 μm for the test surface and 0·8 μm for the bottom surface; the sampling length, l is 0·80 mm.

2.6 In order to check that no material has been subsequently removed from the standardized block, its thickness at the time of standardization shall be marked on it to the nearest 0·01 mm, or an identifying mark shall be made on the test surface (*see* **7**).

3. STANDARDIZING MACHINE

3.1 In addition to fulfilling the general conditions specified in IS : 1754 (Part 1)-1986* the standardizing machine shall also meet the requirement of **3.2**.

3.2 The machine shall be verified directly. Direct verification involves:

a) Verification of the test force (*see* **3.2.1**);

b) Verification of the indenter (*see* **3.2.2** to **3.2.5**); and

c) Verification of the measuring device (*see* **3.2.6**).

3.2.1 Each test force shall be accurate to within $\pm$0·2 percent of the nominal test force as given in Table 1.

3.2.2 The four faces of the square based diamond pyramid shall be highly polished, free from surface defects and flat within 0·000 3 mm.

*Verification of Vickers hardness testing machines: Part 1 HV 0·2 to HV 100 (*second revision*).

TABLE 1 TEST FORCE

(*Clause* 3.2.1)

HARDNESS SYMBOL	NOMINAL TEST FORCE, *F* N
HV 0·2	1·961
HV 0·3	2·942
HV 0·5	4·903
HV 1	9·807
HV 2	19·61
HV 2·5	24·52
HV 3	29·42
HV 5	49·03
HV 10	98·07
HV 20	196·1
HV 30	294·2
HV 50	490·3
HV 100	980·7

3.2.3 The angle between opposite faces of the vertex of the diamond pyramid shall be 136 $\pm$ 0·1°.

3.2.3.1 The inclination of the axis of the diamond pyramid to the axis of the indenter holder (normal to the seating surface) shall be less than 0·3°.

3.2.4 The point of the diamond shall be examined with a high power microscope or preferably in a interference microscope and, if the four faces do not meet in a point, the line of junction between opposite faces shall be less than 0·001 mm in length.

3.2.5 It shall be verified that the quadrilateral which would be formed by the intersection of the faces with a plane perpendicular to the axis of the diamond pyramid has angles of 90 $\pm$ 0·2°.

3.2.6 The scale of the measuring microscope shall be graduated to permit subdivision for estimation of the diagonals of the indentation to within 0·1 percent of d for $d > 0{\cdot}2$ mm and to within 0·000 2 mm for $d \leqslant 0{\cdot}2$ mm.

3.2.7 The scale of the measuring microscope shall be verified by measurements made on a stage micrometer or any other suitable measuring device at a minimum of five intervals over each working range. The difference between readings corresponding to any two graduation lines of the measuring microscope shall be correct to within $\pm$0·1 percent of d for $d > 0{\cdot}5$ mm and to within $\pm$0·000 5 mm for $d \leqslant 0{\cdot}5$ mm.

4. STANDARDIZING PROCEDURE

4.1 The standardized block shall be calibrated in a standardizing machine as described in **3** using the general procedure specified in IS : 1501 (Part 1)-1984* and IS : 1501 (Part 2)-1984†. The calibration shall be carried out a temperature of 20 ± 2°C for temper climates and 27 ± 2°C for tropical climates.

4.2 The time from the initial application of force until the full test force is reached and the approach velocity (alternative 1) or the controlled speed of the indenter at the end of the penetration (alternative 2) shall meet the requirements given in Table 2. The duration of the test force shall be 13 to 15s.

TABLE 2

Test Force, F	Alternative 1		Alternative 2
	Time for Application of the Force	Approach Velocity of the Indenter	Controlled Speed of the Indenter at the End of Penetration
N	s	mm/s	μm/s
$1{\cdot}96 \leqslant F < 49{\cdot}03$	No requirement	0·05 to 0·2	5 to 10
$49{\cdot}03 \leqslant F \leqslant 980{\cdot}7$	6 to 8	0·05 to 1	5 to 10

5. NUMBER OF INDENTATIONS

5.1 On each standardized block, five indentations shall be made uniformly distributed over the entire test surface.

6. UNIFORMITY OF HARDNESS

6.1 Let d_1, d_2....., d_5 be the arithmetic mean values of the measured diagonals, arranged in increasing order of magnitude.

The non-uniformity of the block under the particular conditions of standardization is characterized by the difference $d_5 - d_1$ and expressed in percent of $\bar{d}$, where

$$\bar{d} = \frac{d_1 + d_2 + \ldots + d_5}{5}$$

6.2 The block is not sufficiently uniform in hardness for standardization purpose unless the uniformity satisfies the conditions given in Table 3.

*Method for Vickers hardness test for metallic materials: Part 1 HV 5 to HV 100 (*second revision*).

†Method for Vickers hardness test for metallic materials: Part 2 HV 0·2 to less than HV 5 (*second revision*).

TABLE 3 PERMISSIBLE NON-UNIFORMITY OF HARDNESS

(*Clause* 6.2)

HARDNESS OF BLOCK	MAXIMUM PERMISSIBLE NON-UNIFORMITY OF d PERCENT	
	HV 0·2 to less than HV 5	HV 5 to HV 100
⩽ 225 HV	3·0	2·0
> 225 to 400 HV	1·5	1·0
> 400 HV	2·0	1·5

7. MARKING

7.1 Each standardized block shall be marked with the following:

a) Airthmetic mean of the hardness values found in the standardizing test, for example;

249 HV 30

b) Name or mark of the supplier;

c) Serial number;

d) Name or mark of the standardizing authority; and

e) Thickness of the block or an identifying mark on the test surface.

7.2 Any mark put on the side of the block shall be the right way up when the test surface is the upper face.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2